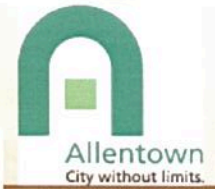
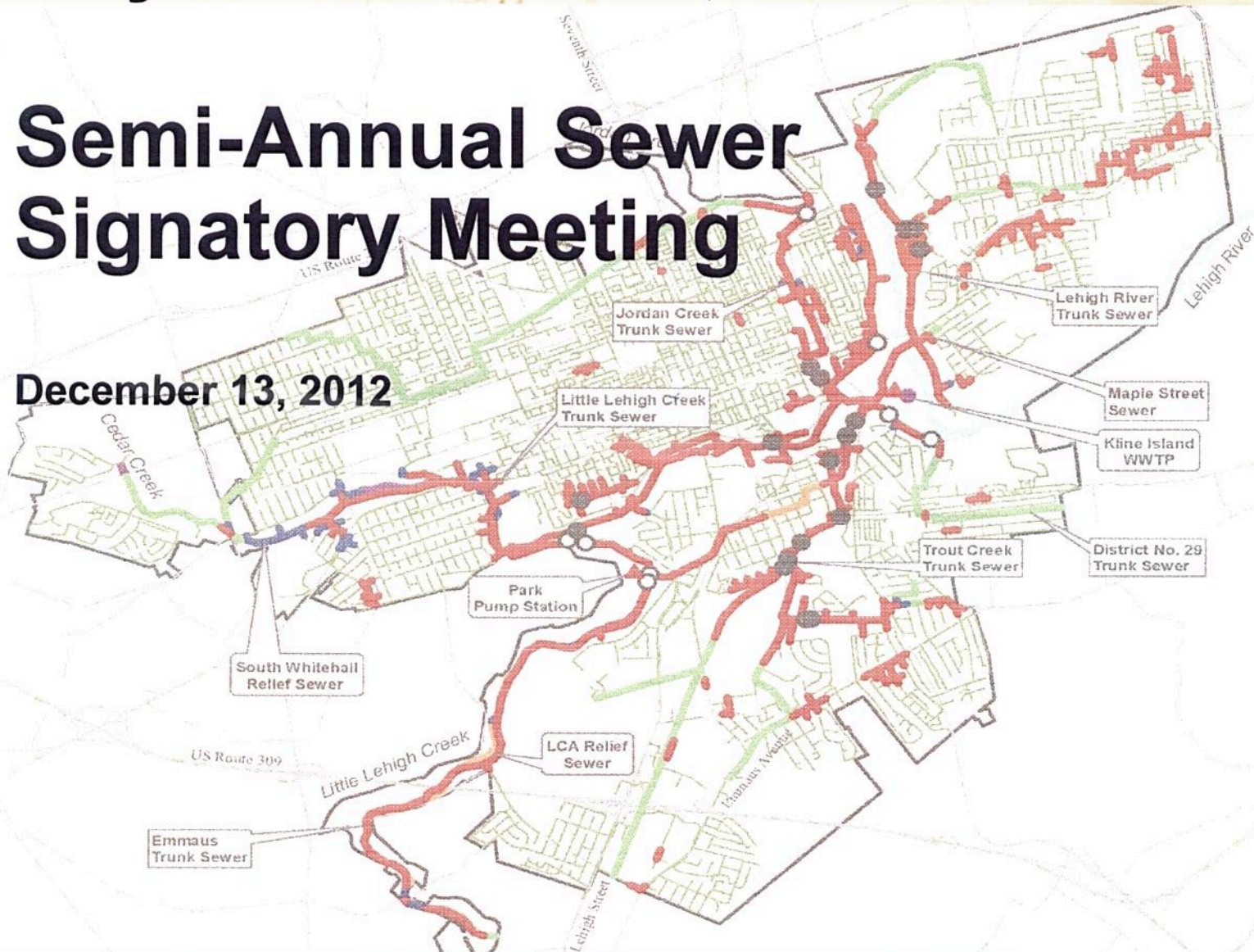


City of Allentown, PA



Semi-Annual Sewer Signatory Meeting

December 13, 2012



Whitman, Requardt and Associates, LLP



Outline of Today's Presentation

- **Summary of Model development and calibration**
- **SSO locations based on a 10-year storm**
- **Analyses of Individual Improvements**
 - Effects of Signatory flows
 - RDII analysis
 - FM Extension
 - Flow EQ Basin (COM FEB)
 - Parallel Sewer
 - Sealing of MH's
- **Alternatives for Elimination of SSO's**
- **Review of Results**
- **Conclusions**

Model Development and Calibration

- **Model Calibration Summary**
 - Calibration achieved for 169 metering locations from 2008 flow data
- **Modified-Calibrated Model**
 - Inclusion of excess inflow to system to mimic high antecedent moisture conditions
- Results bracketed between normal and severe wet weather periods

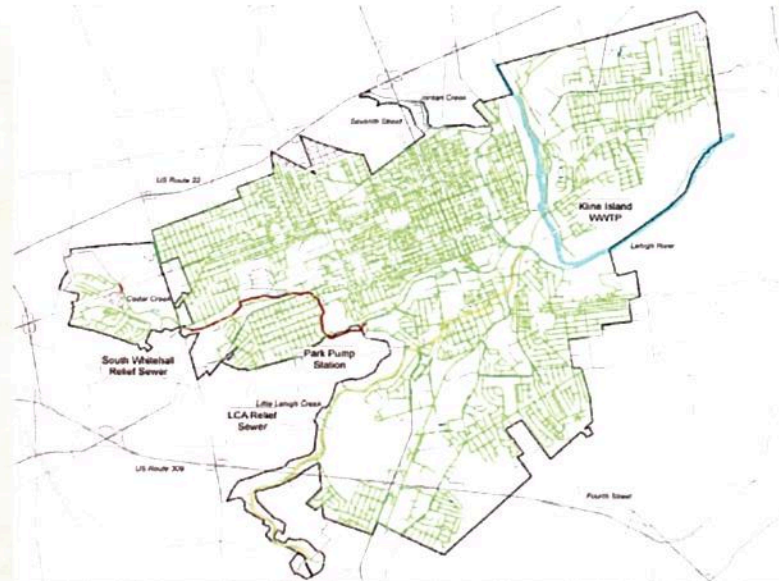


City of Allentown, Pennsylvania

RDII Removal Corrective Action
Plan Phase 1

Model Development and
Calibration Report
Draft

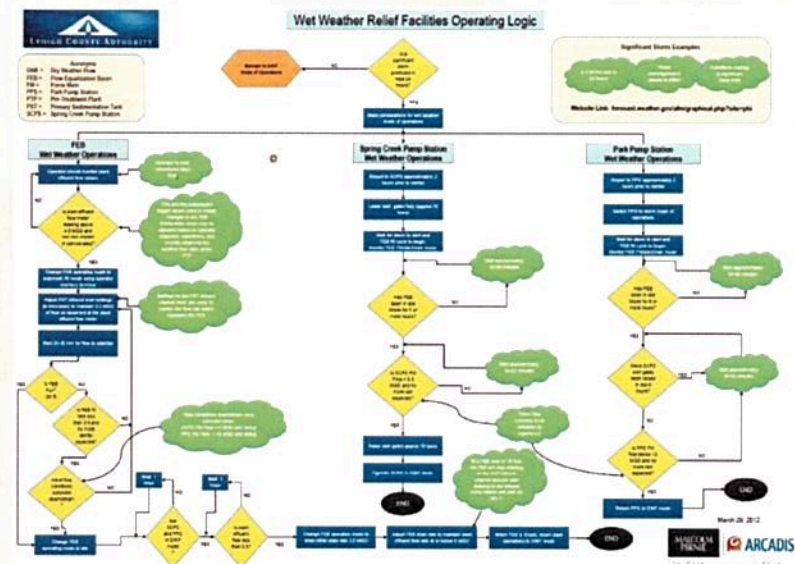
August 2012



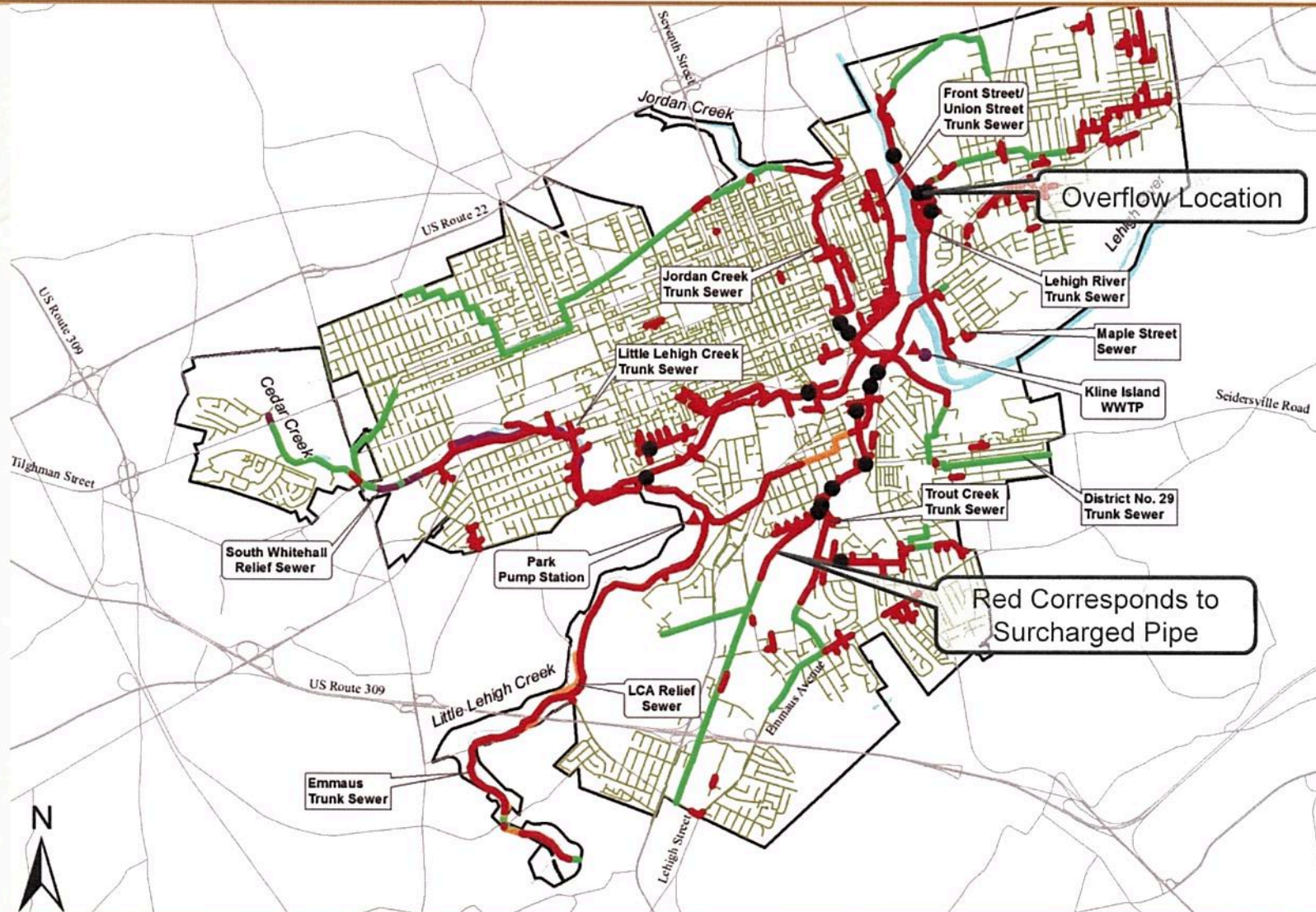
WR&A WHITMAN, REQUARDT & ASSOCIATES, LLP
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Model Modifications

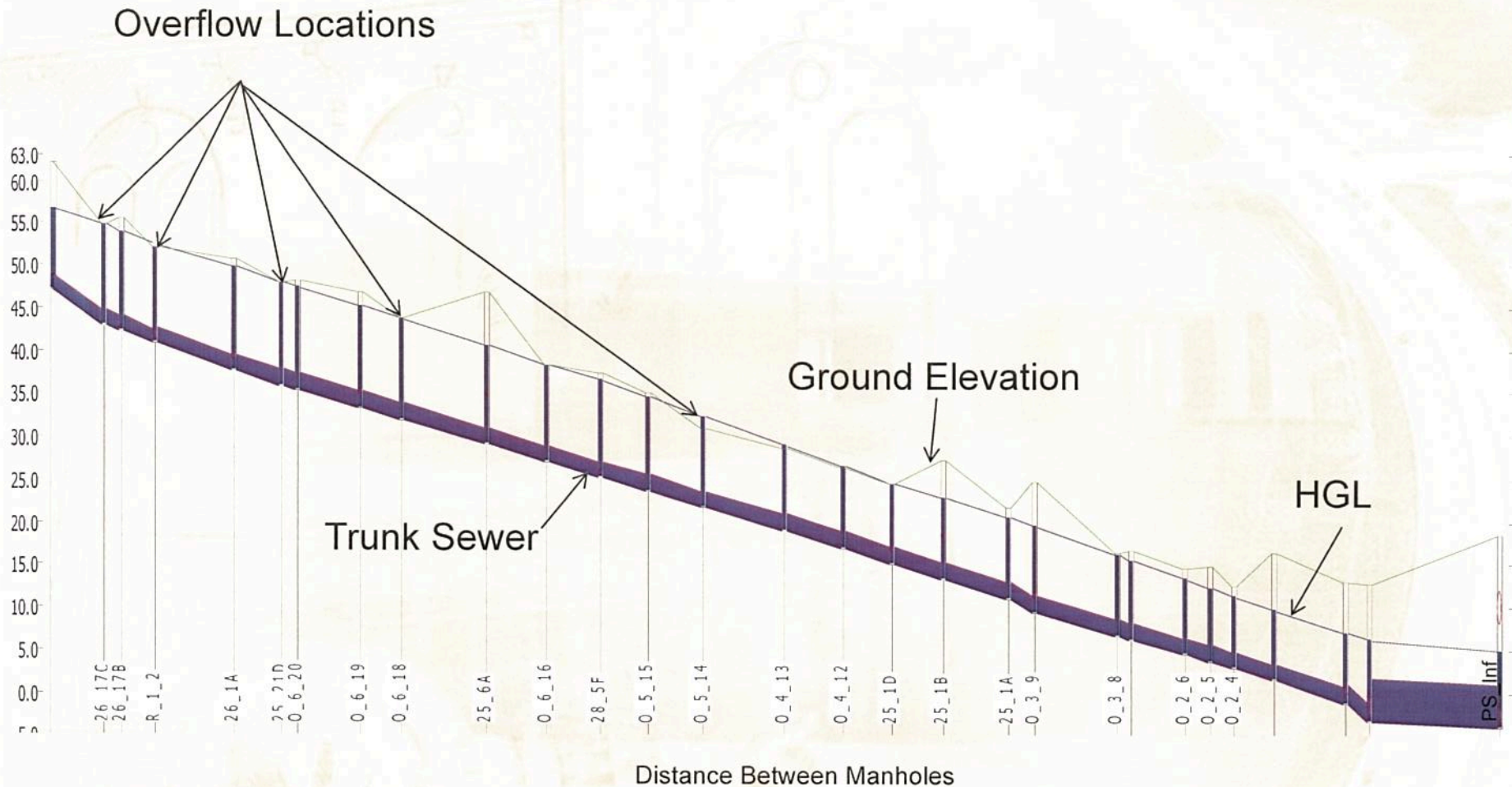
- **LCA FEB – LCA's new Flow Equalization Basin**
- **Inputted LCA's operating logic**
- **LCA FEB modeled at flow input node**
 - 3 MG
 - Flows to LCA FEB at 6 MGD
 - Flows out of LCA FEB at 2 MGD
- **Under the 10-year Storm**
 - 1.5 MG overflow reduction
 - 32% overflow reduction
- **All results/modeling runs include the LCA FEB**



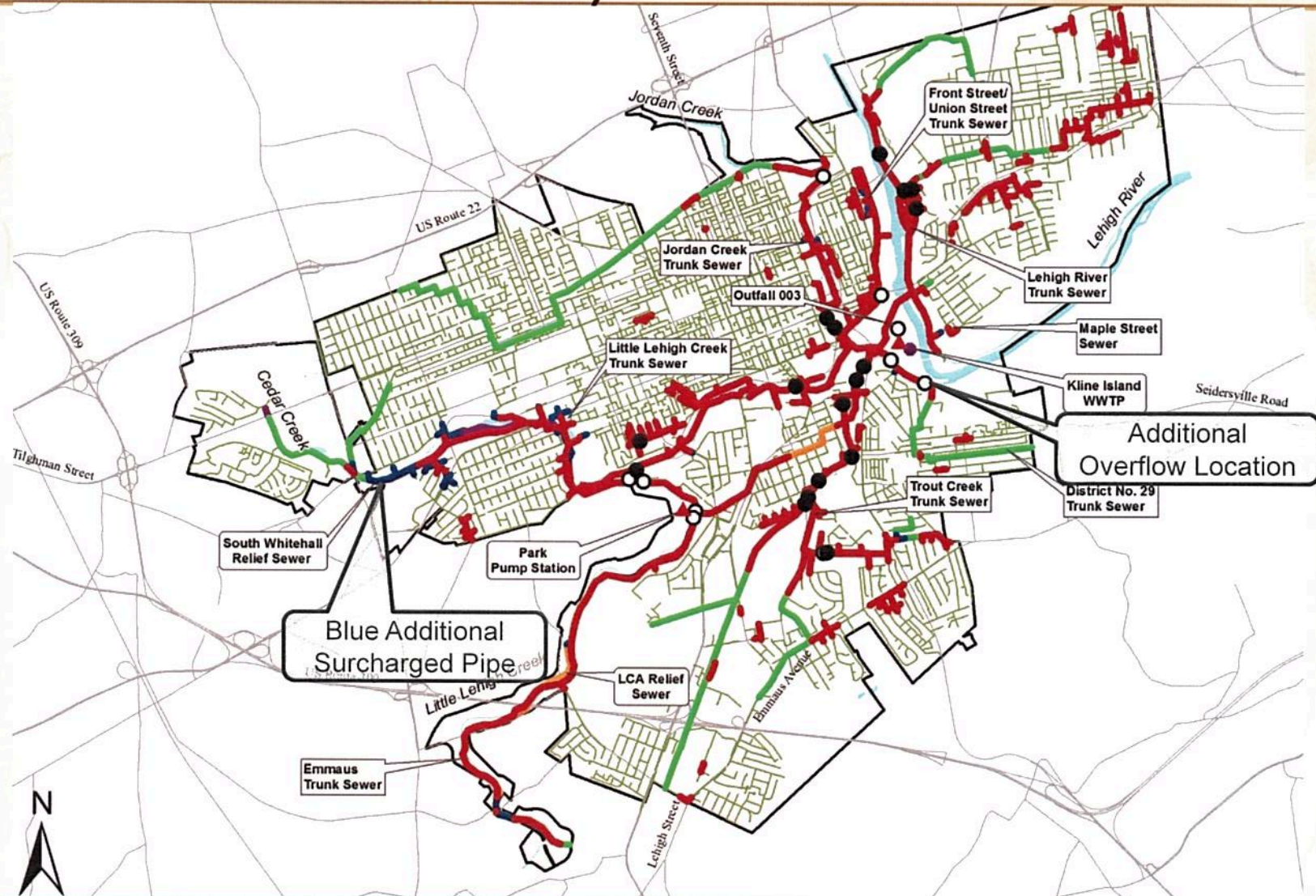
SSO Locations Based on a 10-year Storm



Profile Based on a 10-year Storm (Trout Creek Trunk Sewer)



SSO Locations Based on a 10-year Storm (Modified-Calibrated Model)



Effects of Signatory Flows

- **Sensitivity Analysis to Determine Impacts of Signatory Flows**
 - Wet weather related flows and peaks contribute to overflows, not the dry weather flows
 - 40 percent reduction of Signatory flows would significantly decrease the overflows and surcharge

Basis of Analysis	Volume Lost (MG)	Number of SSO Locations	SSO Volume Reduction %
BASE - Calibrated Model	3.21	17	--
Signatory Flows Limited to Dry Weather Levels	0.72	8	78%
Signatory Flows Removed	0.68	8	79%
Reduced Signatory RDII (40% reduction)	1.12	11	65%

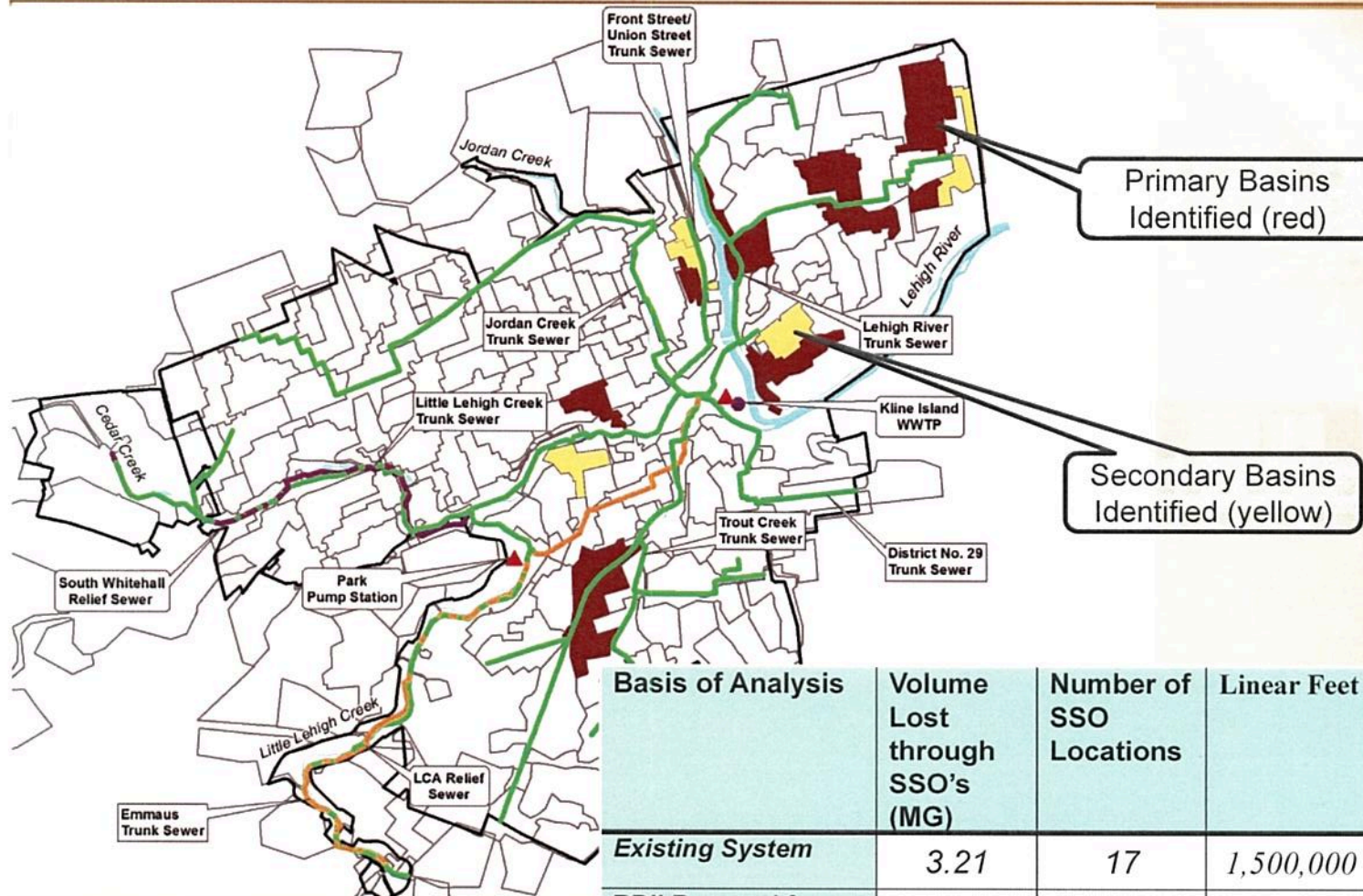
RDII Analysis

- **Identification of Areas for RDII Removal**
 - Normalization and Ranking by IDM
 - Basins where overflows occur
 - Grouping of basins
 - Greatest probability of RDII reduction
- **Basins were identified to study RDII removal effectiveness**

RDII Sensitivity Analysis

- **Assumed RDII removal rate of 40%**
 - **Theoretical**
 - **Actual removal rates are difficult to determine and could vary significantly**
- **Determination if RDII removal alone can eliminate SSO's for a 10-year storm**
 - **40 percent RDII removal City-wide resulted in one SSO location remaining → RDII removal alone is not the solution**
- **Targeted RDII Removal**

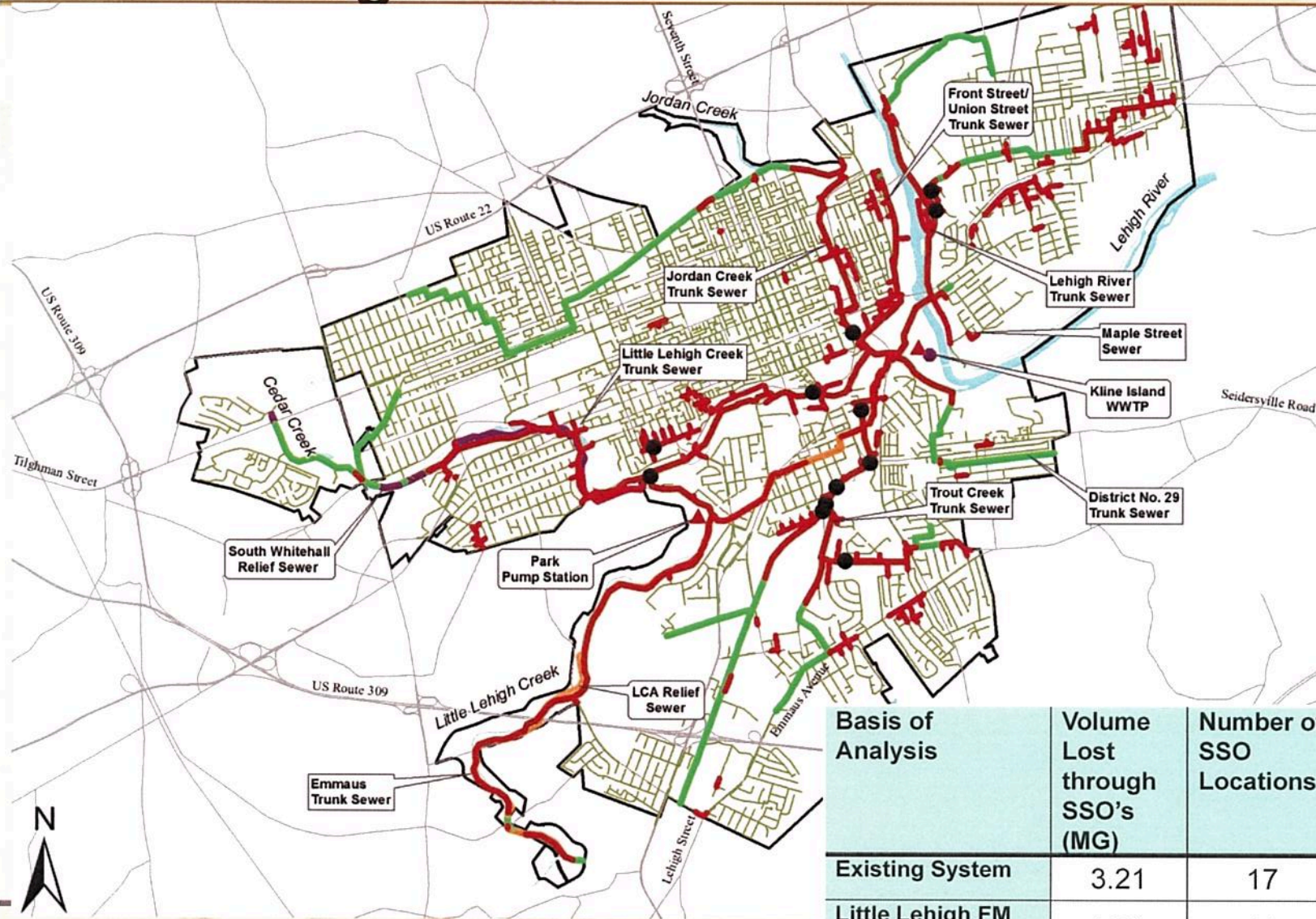
Targeted RDII Removal



Basis of Analysis	Volume Lost through SSO's (MG)	Number of SSO Locations	Linear Feet	% of total system	SSO Volume Reduction (%)
Existing System	3.21	17	1,500,000	--	--
RDII Removal for Primary and Secondary Basins	2.39	11	124,202	8%	25%

Previously Identified Improvements

Little Lehigh FM Extension



Basis of Analysis	Volume Lost through SSO's (MG)	Number of SSO Locations	SSO Volume Reduction (%)
Existing System	3.21	17	--
Little Lehigh FM Extension	1.71	11	47%

Additional Improvements

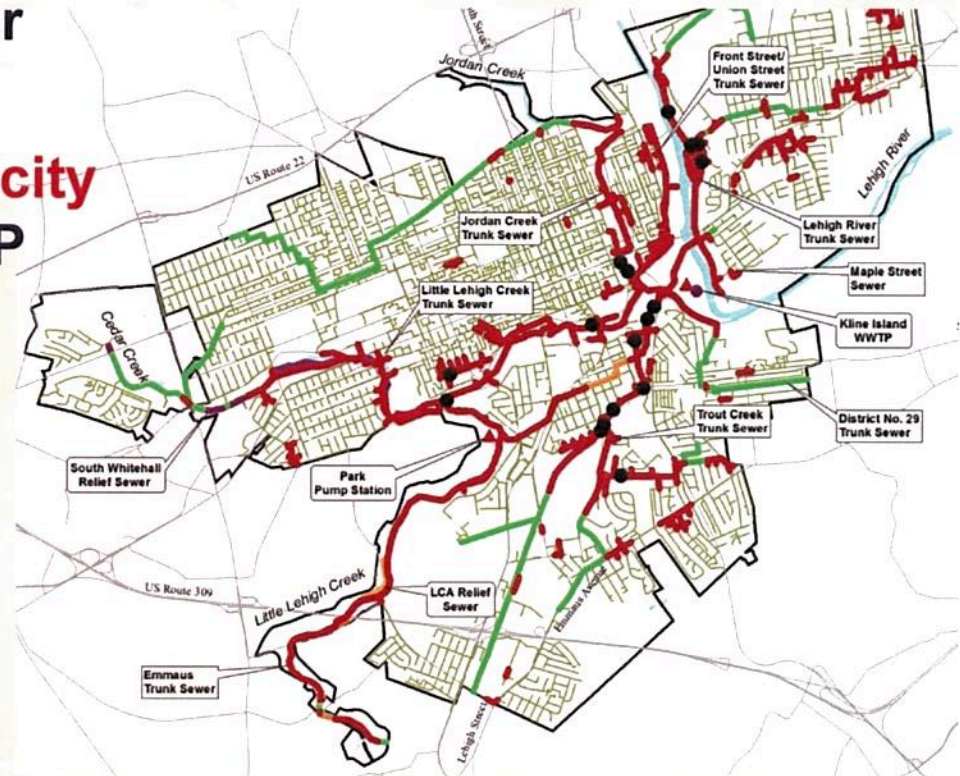
- Apparent Capacity Issues
 - Trout Creek Trunk Sewer
 - Little Lehigh Trunk Sewer

**Solution: Parallel Sewers
And Increase in Park PS Capacity**

- Elevated HGL at the KIWWTP
IPS

**Solution: Flow Equalization
Basin (IPS FEB)**

- Sealing of Existing MH's
 - 181 MH's already sealed
 - 20 additional MH's modeled to be sealed



Increasing Park Pumping Station Capacity

- **LCA and South Whitehall flows are ~30 MGD peak for a 10-year storm**
- **Increase peak flows through Park Pumping Station to 30 MGD (for modified-calibrated model 40 MGD is necessary)**
- **Increasing PS flows may necessitate upsizing portions of the force main to 30-inches**

Flow Equalization Basin (MPH FEB)

- MPH FEB modeled to reduce HGL at the KIWWTP IPS
- Various other methods could accomplish lowering HGL
- MPH FEB
 - 48-inch pipeline to storage
 - Maximum surcharge of 1 foot on influent sewer (currently max of 7 feet)
 - Maximum volume of 4 MG (less if combined with other improvements)
- Significant reduction in overflow volumes and SSO locations

Basis of Analysis	Volume Lost through SSO's (MG)	Number of SSO Locations	SSO Volume Reduction (%)
Existing System	3.21	17	--
MPH FEB	1.81	12	44%





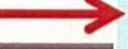
Combined Flow Equalization Basin (COM FEB)

- **Combines MPH FEB and flow equalization basin associated with force main extension from Park Pumping Station**
- **Would eliminate the need for two FEB's at the KIWWTP**
- **Volume would vary depending on other improvements**

Combining Various System Improvements

- Combined effects are not additive
- Improvements combined based on their ability to remove SSO volume or eliminate SSO locations
- Ten (10) Alternatives developed

Alternatives for Eliminating System SSO's

Basis of Analysis	Alternative Summary	Volume Lost through SSO's (MG)	Number of SSO Locations	SSO Volume Reduction (%)
<i>Existing System</i>	--	3.21	17	--
Alternative 1	FM extension, RDII removal (primary and secondary), IPS FEB	1.44	16	55%
Alternative 2	FM extension, RDII removal (primary), IPS FEB	1.50	13	53%
Alternative 3	FM extension, RDII removal, IPS FEB, Trout Creek Parallel	1.02	5	68%
Alternative 4	FM extension, RDII removal, IPS FEB, Trout Creek Parallel, 40% Signatory Flow Reduction	0.25	3	92%
 Alternative 5	FM extension, RDII removal, IPS FEB, Trout Creek Parallel, 40% Signatory Flow Reduction, Sealed MH	0	0	100%
 Alternative 6	FM extension, RDII removal, IPS FEB, Trout Creek and Little Lehigh Parallel, 40% Signatory Flow Reduction, Sealed MH	0	0	100%
 Alternative 7	FM extension, RDII removal, IPS FEB, Trout Creek and Little Lehigh Parallel, 10% Signatory Flow Reduction, Sealed MH	0	0	100%
 Alternative 8	FM extension, RDII removal, IPS FEB, Trout Creek and Little Lehigh Parallel, Sealed MH	0	0	100%
Alternative 9	FM Extension, RDII Removal, Trout Creek Trunk Parallel, Sealed MH, Park PS/FM Upgrade, COM FEB	0.06	2	98%
 Alternative 10	FM Extension, RDII Removal, Trout Creek Trunk Parallel, Sealed MH, Park PS/FM Upgrade, COM FEB, 40% RDII Signatory Flow Reduction	0	0	100%

Alternatives for Eliminating System SSO's – Modified-Calibrated Model

Basis of Analysis	Alternative Summary	Volume Lost through SSO's (MG)	Number of SSO Locations	SSO Volume Reduction (%)
Existing System	--	10.57	27	--
Alternative 1	FM extension, RDII removal (primary and secondary), IPS FEB	6.56	16	38%
Alternative 2	FM extension, RDII removal (primary), IPS FEB	6.75	16	36%
Alternative 3	FM extension, RDII removal, IPS FEB, Trout Creek Parallel	6.26	13	41%
Alternative 4	FM extension, RDII removal, IPS FEB, Trout Creek Parallel, 40% Signatory Flow Reduction	2.06	5	81%
Alternative 5	FM extension, RDII removal, IPS FEB, Trout Creek Parallel, 40% Signatory Flow Reduction, Sealed MH	1.00	3	91%
Alternative 6	FM extension, RDII removal, IPS FEB, Trout Creek and Little Lehigh Parallel, 40% Signatory Flow Reduction, Sealed MH	0.12	1	99%
Alternative 7	FM extension, RDII removal, IPS FEB, Trout Creek and Little Lehigh Parallel, 10% Signatory Flow Reduction, Sealed MH	1.46	7	86%
Alternative 8	FM extension, RDII removal, IPS FEB, Trout Creek and Little Lehigh Parallel, Sealed MH	2.40	9	77%
Alternative 9	FM Extension, RDII Removal, Trout Creek Trunk Parallel, Sealed MH, Park PS/FM Upgrade, COM FEB	0.67	6	94%
Alternative 10	FM Extension, RDII Removal, Trout Creek Trunk Parallel, Sealed MH, Park PS/FM Upgrade, COM FEB, 40% RDII Signatory Flow Reduction	0	0	100%

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Conclusions

- **Alternatives 5 through 10 adequately address EPA's AO under both scenarios**
- **Alternatives 6 and 10**
 - Eliminates overflows under normal wet weather conditions (calibrated model) and high inflow/antecedent moisture conditions (modified-calibrated model)
 - Requires Signatory participation
- **Alternate combinations of improvements and Signatory flow reductions can be investigated**

Phase II Corrective Action Plan

- **SSES studies for selected basins**
- **Detailed hydraulic system evaluations**
 - Volume of FM FEB
 - Volume of a combined FM FEB and MPH FEB
 - Studies of HGL at the KIWWTP IPS
 - Park Pumping Station Capacity
 - KIWWTP IPS operating levels
 - Size and length of parallel pipelines
 - Surge evaluations
 - Determination of Signatory flow reduction
 - Review of LCA FEB operational set-up
- **Determination of Costs and Final Alternative**
- **Other: Evaluation of Work Under the 537 Plan**

Outline of Future Efforts

- **Additional Flow Metering ???**
- **Analysis of Flow Metering Data**
- **Phase II CAP**
 - Hydraulic Evaluations
 - SSES Work Plan
 - Review of Data and Compilation of Recommendations
- **EPA Approval, Project Phasing, Schedule Adjustment**
- **Design of Recommended Improvements**
- **Construction of Recommended Improvements**
- **Other**
 - Work under 537 Plan
 - Allentown Lease of System/Privatization
 - Negotiations with the Signatories
 - Other?



Whitman, Requardt and Associates, LLP

Questions/Comments

engineers

architects

planners

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